Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc. in Computer Science
Effective from academic session 2023-24

Semester-V

Paper Name: Operating Systems/ Operating Systems Lab

Code: CS 501/ CS 591

Contacts: 3L + 2P

Course Objective:

CO1. To learn the mechanisms of OS to handle processes and threads and their communication
CO2. To learn the mechanisms involved in memory management in contemporary OS
CO3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
CO4. To know the components and management aspects of concurrency management

Unit	Content
1	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS.
2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR.
3	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.
4	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.
5	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of Paging. **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

6 **I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

7 **File Management**: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Operating Systems Lab:

1. Managing Unix/Linux Operating System

Basic Unix/Linux command (creating file, display file, copying file, renaming fie, deleting file, moving file, creating directories, removing directories, change directories, file permission etc.), basic filter command, vi editor, advanced filtercommand

2. Shell Scripting
Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

3. User Administration
Password file management, Shadow file, Groups and the group file, user-management commands, setting passwords, creating & removing users & user groups.

Text book and Reference books:

1. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook)
2. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley AsiaStudent Edition.
3. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates
8. Operating System and Unix, S. Gayathri; S. Priyadharshini; N. S. Usha, Khanna Publishing House.

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Paper Name: Advanced Java Programming / Advanced Java Programming Lab

Code: CS 502/ CS 592

Contacts: 3L + 2P

Course Objective:

CO1.To be familiarize with RMI and JSP
CO2.To understand the Java Servlets and Database connectivity
CO3.To know more about the Enterprise Java Bean (EJB) Programming

Module 1: Java Servlets

Servlet as J2EE Web Component, Servlet as a better CGI Fundamentals / API of Servlet, What is a Web-Container, The Life cycle of Servlet / Architecture, Handling HTTP Request and Response Method,(e.g. GET and POST), Name-Value pair, Content Types and MIME, Web Application Configuration, Being aware of the Deployment Descriptor (DD) and web.xml or The concept of Deployment Descriptor (DD) /web.xml, Pattern mapping for Servlet URLs, Init Parameters, State Management, Using HTTP Session and Cookies, Request Dispatcher- Servlet config Method

Module 2: Extensible Markup Language (XML)

Extensible Markup Language (XML), Introduction to XML, Understanding DOM, Using DOM in Java, Concept of StAX in Java, Programming with StAX

Module 3: Java Database Connectivity (JDBC)

Overview of RDBMS, Introduction to Call Level Interface(CLI), Introduction to JDBC, Architecture of JDBC, Types of JDBC Drivers, Creating a JDBC Connection, Statement- Prepared and Callable Statement, Scrollable and Updatable Result Set, Record Inserting & Fetching from Database, Managing Transactions in JDBC

Module 4: Java Server Pages (JSP)

Introduction of JSP, Life Cycle of JSP, Request and Response Method, Handling the Session, Page- Page Context, Exception Handling, JSP Page Implementation Class, JSP Directive Tags- Page Directive, Include Directive, Taglib Directive, JSP Action Tags- Forward Action Tag, Include Action Tag, JSP Script related Tags- Scriptlet Tag, Expression Tag, Declaration Tag, Using Java Beans from JSP- UseBean Tag, setProperty Tag, getProperty Tag, JSP Custom Tag Library, Empty Tag, JSP Fragment

Module 5: Common Gateway Interface

Introduction to CGI
Features of CGI
Understanding Environment Variables
Advantage and Disadvantages of CGI

Module 6: JavaBeans

JavaBean Architecture Characteristics of JavaBean
Properties & Methods

Module 7: Applet, AWT and Event Handling

Basic Concept of Applet-Applet Architecture
Passing parameter to AppletgetDocumentBase() and getCodeBase()
AWT classes and graphics
AWT controls Event Handling- Event class, Event Listener Interface, Layout and Menu

Module 8: Swing

Basic concept of Swing, Exploring Swing- JLabel and JTextField, Swing Button

Advanced Java Programming Lab

Sample practical problems can be included related to theory as follows

Assignments:

1. Library Management System using JSP, Servlet, JDBC, JavaBeans
2. Employee Management System using Spring MVC, Spring JDBC, Maven, Java 8
3. File explorer and display of selected file in display pane using Swing
4. Calculator using Applet, AWT and Event Handling

Books/ References

1. Black Book "Java server programming" J2EE, 1st ed.,
2. Java Programming, Sheema D.; Aiswarya S.; A. Lakshna, Khanna Publishing House.
3. Dream Tech Publishers, 2008. 3. Kathy walrath" 2.
4. Complete Reference J2EE by James Keogh mcgraw publication
5. Core Java, Volume II: Advanced Features by Cay Horstmann and Gary Cornell Pearson Publication
6. Java Persistence with Hibernate by Christian Bauer, Gavin King
7. Spring in Action 3rd edition, Craig walls, Manning Publication
8. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication

9. Java Server Faces in Action, Kito D. Mann, Manning Publication
10. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
11. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress
12. JSF2.0 CookBook, Anghel Leonard, PACKT publication

Paper Code: Cryptography and Information Security

Code: CS 503

Contacts: 3L + 1T

Course Objectives:

CO1.Explain the objectives of information security
CO2.Explain the importance and application of each of confidentiality, integrity, authentication and availability
CO3.Understand various cryptographic algorithms.
CO4. Understand the basic categories of threats to computers and networks
CO5. Describe public-key cryptosystem.
CO6. Describe the enhancements made to IPv4 by IP Sec
CO7. Understand Intrusions and intrusion detection
CO8. Discuss the fundamental ideas of public-key cryptography.
CO9. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
CO10. Discuss Web security and Firewalls

Module 1

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles ofsecurity, Types of Security attacks, Security services, Security Mechanisms, A model for Network
Security

Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

Module 2

Symmetric key Ciphers: Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Crypt analysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption
Function, Key distribution

Asymmetric key Ciphers: Principles of public key crypto systems, Algorithms (RSA,

Diffie-Hellman, ECC), Key Distribution.

Module 3

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, HMAC, CMAC, Digital signatures, Public – Key Infrastructure, Biometric Authentication.

Module 4

E-Mail Security: Pretty Good Privacy, S/MIME

IP Security: IP security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

Module 5

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction

Intruders, virus and Firewalls: Intruders, Intrusion detection, password management, virus and related threats, Countermeasures, Firewall design principles, types of firewalls

Reference Books:

1. Cryptography and Network Security: William Stallings, Pearson Education,4″‘ Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill Edition
3. Cryptography and Network Security: C K Shyamala, N Harin i, Dr T R Padmanabhan, Wiley India, 1”
4. Cryptography and Network Security: Forouzan Mukhopadhyay, MC Graw Hill, 2″” Edition
5. Information Security, Principles and Practice: Mark Stamp, Wiley India.
6. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH
7. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
8. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning
9. Cryptography and Network Security: V.K. Jain, Khanna Publishing House (AICTE Recommended Textbook)